Aircraft Tracking, FlightAware, and How You Can Be of Service

Use your ham radio skills to contribute to this global flight-tracking system.

Kevin Parmenter, KG5Q

Many readers are aware that many aircraft calculate their location and speed based on GPS, or similar technologies. An aircraft's altitude is measured by a pressure altimeter on board. *Pitot tube* pressure sensors can also provide speed data as a primary or secondary indication. Not only is this information used by the crew, aircraft with an *ADS-B* (Automatic Dependent Surveillance – Broadcast) transponder broadcast their identification and three-dimensional position (latitude, longitude, altitude) at 1,090 MHz (or 978 MHz for lower-altitude aircraft in the US, using a different technology), which can be received by a radio within line of sight of the aircraft (a maximum of approximately 250 miles/400 kilometers at cruise altitude).

Thousands of ADS-B ground receivers around the world send this data over real-time connections to FlightAware,[1] a global aviation software company that aggregates the data and provides flight tracking information to the public, as well as private customers and government agencies.

This information can be critical in situations where an aircraft is reported overdue and potentially lost. ADS-B tracking data can play a key role in recovery efforts by providing the plane's last reported position.

Approximately 70% of airliners around the world, and 10% of private aircraft, are currently equipped with ADS-B transponders, whereas nearly 100% have Mode-S transponders. Aircraft equipped with ADS-B emit their exact positions; Mode-S aircraft can be tracked via multilateration (MLAT). When a Mode-S signal is received by four or more receivers at the same time, FlightAware's multilateration system can derive the aircraft's position.

The FlightAware system is *crowd-sourced*, which is to say that it depends on data collected from thousands of individuals throughout the world who have set up ADS-B receiving stations. This is where we come in. With our communications knowledge, hams are prime candidates to join the FlightAware monitoring network as effective contributors.

Power, Location, and a Reliable Internet

The first thing you'll need is reliable power to keep your receiver system online continuously — 365 days a year. Power solutions include many of the things you probably employ during a typical Field Day: uninterruptable power supplies, battery backups, generators, or anything else that will keep your system running in the event of power failures.

Next, you will need a location for the ADS-B antenna that offers 360-degree coverage. This can be on a tower or rooftop. Your location doesn't have to be perfect (even a window will do), but for optimum results, the antenna needs an unobstructed line-of-sight to the sky and out to the horizon.

Finally, you need a reliable internet connection. This can either be wired or Wi-Fi. Because few home internet connections are 100% reliable, you might consider a special type of router that defaults

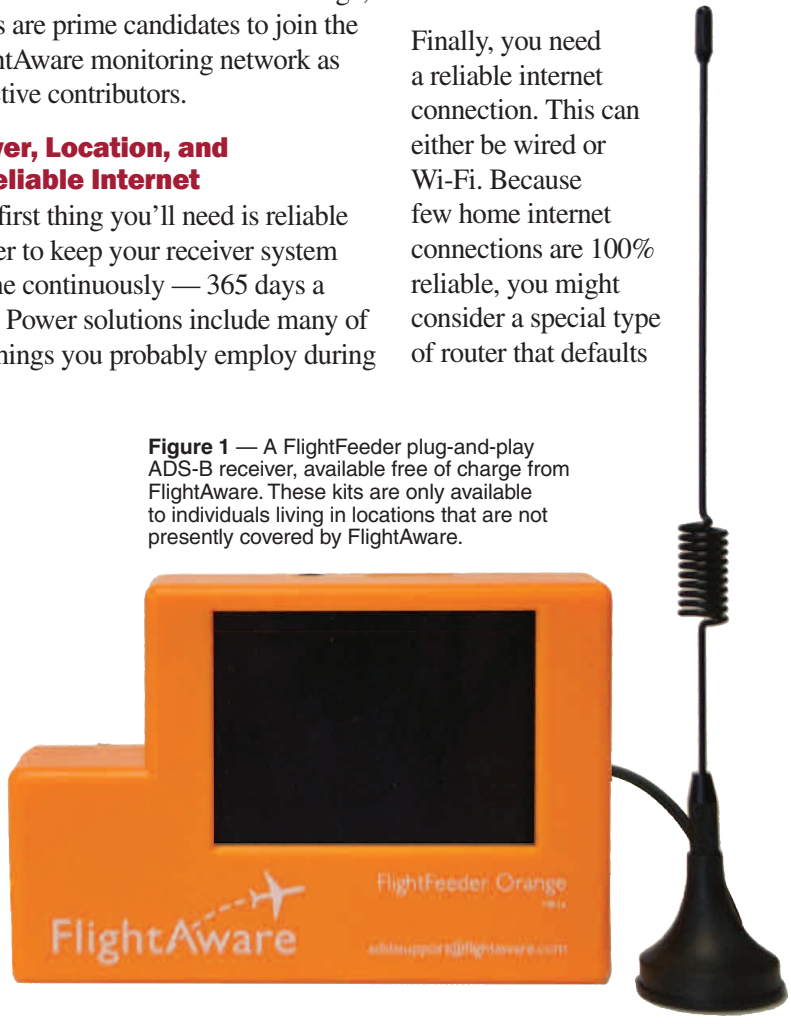

Figure 1 — A FlightFeeder plug-and-play ADS-B receiver, available free of charge from FlightAware. These kits are only available to individuals living in locations that are not presently covered by FlightAware.

to a 4G cellular backup connection if the primary home internet connection is lost. Cradlepoint[2] is a prominent manufacturer, although there are others.

Setting up a Receiving Station

At the heart of any FlightAware reception system is an ADS-B receiver. Most ADS-B receivers today are software-defined models, and you can often find them selling for about $100. There is a shopping list and instructions on FlightAware's website at **https://flightaware.com/adsb/piaware/build**.

FlightAware also makes available complete kits that are provided free of charge to individuals who live in areas where there is little, or no, ADS-B monitoring taking place. FlightAware's free plug-and-play kits, called "FlightFeeders," (see Figure 1) can be requested from their website. However, most areas of the United States and Western Europe are already well-covered, so your odds of qualifying for a free kit may be slim.

Many enthusiasts like myself prefer to assemble their own ADS-B receiving stations. Along with the ADS-B receiver (see Figure 2), you will need an omnidirectional antenna, a coaxial feed line, and a computer (commonly a Raspberry Pi 3 dedicated to the purpose). Bear in mind that you're receiving microwave signals, so be sure to use low-loss coax if the antenna is located a substantial distance from the receiver. For many users, especially those in urban areas, a band-pass filter is also desirable to reject interference.

All of these items are available from FlightAware, as well as other sources, such as Amazon. Just search for "ADS-B." You can also build your own ADS-B antenna. See "Virtual Radar from a Digital TV Dongle" by Robert Nickels, W9RAN, in the January 2014 issue of *QST*.

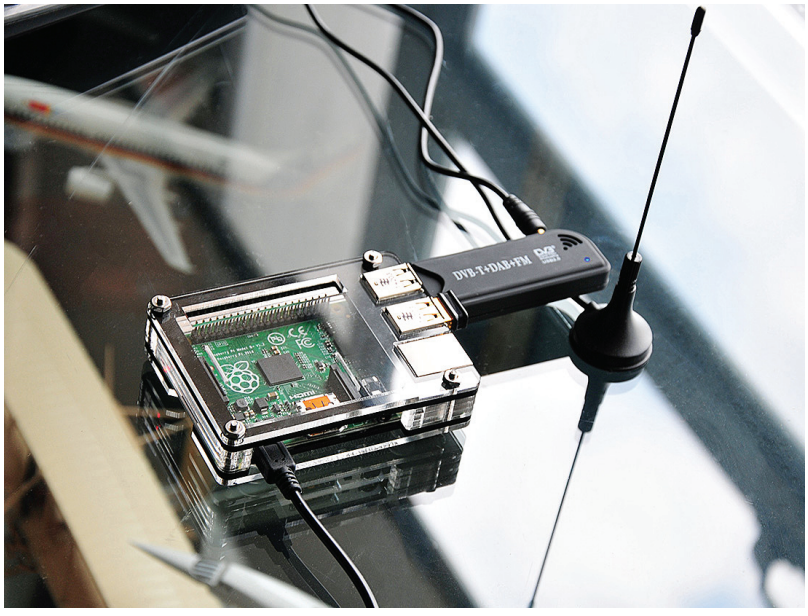

Figure 2 — The author's DIY receiving station.

Finally, you'll need software to decode the ADS-B signals and feed the data to the FlightAware network. FlightAware makes their *PiAware* software available for free for Raspberry Pi devices. If you don't want to use a Raspberry Pi, FlightAware also offers *PlanePlotter* for *Windows*.

Receiving and Sharing Data

Once all the parts are assembled, it won't be long before you start receiving ADS-B transmissions from aircraft in your area. The software should decode the data and verify that you are successfully uploading to the FlightAware network.

In my experience, the set-up process was simple, especially with the FlightAware system providing status updates to let me know everything was running smoothly. The finer details of the setup process include providing FlightAware with your receivers' location and elevation information. This, again, is a straightforward process.

For users building their own receiving stations, which are probably most of us, FlightAware provides a wealth of information on its website and through the worldwide community via its online discussion forums. FlightAware's FlightFeeders stations are remotely managed devices and technical support is provided via e-mail when needed.

Filling in the Coverage

The FlightAware team presently needs data from locations in specific parts of the world, including Alaska, northern Canada, eastern Europe, Russia, China, South America, Africa, Oceania, the Middle East, and much of southeast Asia. The current data coverage map can be viewed on FlightAware's website at **https://flightaware.com/adsb/coverage#data-coverage**. You'll see that there are still some areas of the United States where coverage is needed.[3]

The map in Figure 3 shows ADS-B coverage in green and MLAT coverage on top of that in yellow. Data is aggregated across all altitude levels, and the map should be considered indicative of coverage of airliners at cruising altitudes. Coverage at lower

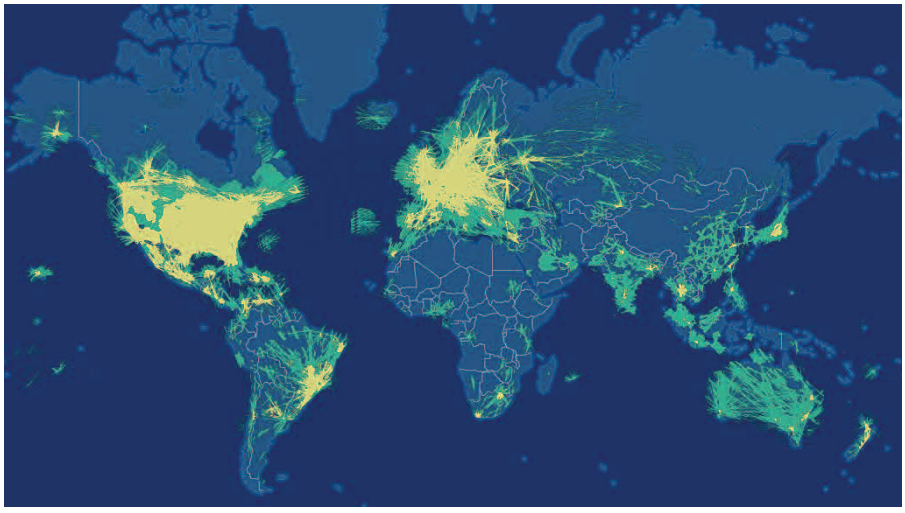

Figure 3 — A FlightAware map showing ADS-B coverage in green and MLAT coverage in yellow.

altitudes is generally less contiguous and benefits from fill-ins by additional receiver sites.

Installing an ADS-B receiving system is surprisingly easy. In my case, I'm monitoring signals in a location where the FlightAware team happened to need coverage. You can go to **https://flightaware.com/adsb/stats/user/kg5q** and view the activity from my station.

Becoming an ADS-B monitoring station is an educational and rewarding way to put our radio skills to work to support aviation safety.

Notes
[1]**www.flightaware.com**
[2]**www.cradlepoint.com**
[3]ADS-B reception may eventually move to satellites. *ECN Magazine*, "This Space Radio Could Change How Flights are Tracked Worldwide," 2017 Advantage Business Media. **https://www.ecnmag.com/news/2017/01/space-radio-could-change-how-flights-are-tracked-worldwide?et_cid=5803885&et_rid=650435438&type=headline&et_cid=5803885&et_rid=650435438&linkid=Featured+Headline**

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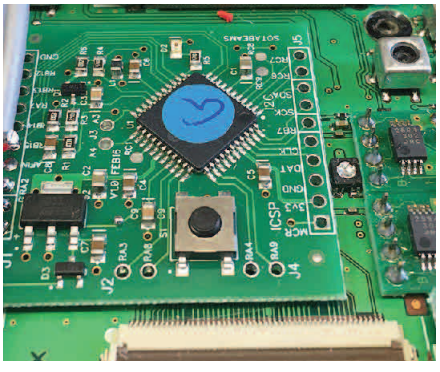
New Products

Filters for the FT-817 from SOTABEAMS

The LASERBEAM-817 fits inside the Yaesu FT-817 QRP transceiver and is said to give improved SSB filtering and also includes a 500Hz CW filter. It can be used with or without the standard optional filters to improve the overall performance of the radio. Switching between SSB and CW is done automatically so fitting the unit does not require holes to be drilled into the radio case. Price: about $46. For more information or to order, visit **www.sotabeams.co.uk.**



Messi and Paoloni Coaxial Cables from MFJ

MFJ has become the US distributor for Messi and Paoloni (M&P) coaxial cables from Italy. The cables feature UV-resistant PVC jackets, copper braid and copper-foil shielding, PE dielectric, and copper center conductors. The M&P-AB5, Airborne 5 (0.195 inch OD) is specified to be lighter than RG-58 but lower loss. M&P-AB10, Airborne 10 (0.405 inch OD) is said to be 43% lighter than 100% copper RG-8 size cable. M&P-HYF5, HyperFlex 5 (0.24 inch OD) is a flexible cable with stranded center conductor. Also available are M&P-HYF10, HyperFlex 10 (0.405 inch OD) and M&P-HYF13, HyperFlex 13 (0.59 inch OD). M&P-UF7, UltraFlex 7 (0.3 inch OD) has high flexibility, with stranded center conductor. Also available are M&P-UF10, UltraFlex 10 (0.405 inch OD) and M&P-UF13, UltraFlex 13 (0.5 inch OD). For more information and pricing, visit your favorite MFJ dealer or **www.mfjenterprises.com**.